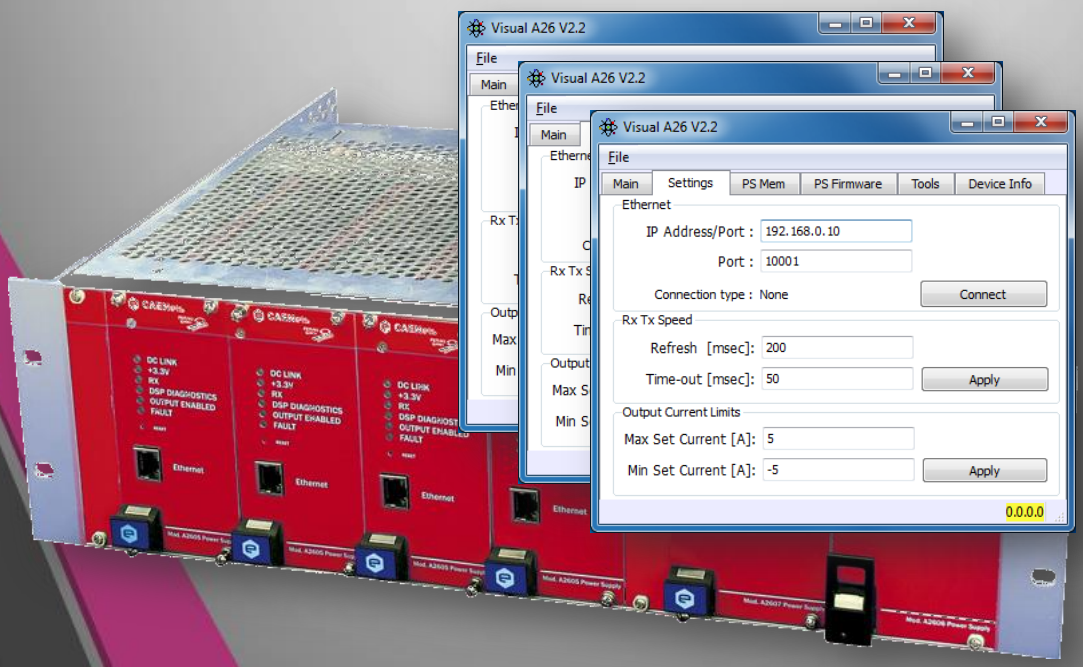
SY2604

Digital Bipolar Power Supply
5A@10V System

CAENels
Gear for Science

Visual SY2604 User's Manual



MAGNET POWER SUPPLY SYSTEMS

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Rev. 1.1 – November 2014

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Document Revision	Date	Comment
1.0	February 20th 2012	First Release
1.1	November 3rd 2014	Manual graphics changed

Safety information - Warnings

CAENels will repair or replace any product within the guarantee period if the Guarantor declares that the product is defective due to workmanship or materials and has not been caused by mishandling, negligence on behalf of the User, accident or any abnormal conditions or operations.

Please read carefully the manual before operating any part of the instrument

WARNING

High voltage inside, do NOT open the boxes

CAENels d.o.o. declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly this User's Manual before any kind of operation.

CAENels d.o.o. reserves the right to change partially or entirely the contents of this Manual at any time and without giving any notice.

Disposal of the Product

The product must never be dumped in the Municipal Waste. Please check your local regulations for disposal of electronics products.

E

Read over the instruction manual carefully before using the instrument.
The following precautions should be strictly observed before using the SY2604:

WARNING

- Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in this manual.
- Do not use the device if it is damaged. Before you use the device, inspect the instrument for possible cracks or breaks before each use.
- Do not operate the device around explosives gas, vapor or dust.
- Always use the device with the cables provided.
- Turn off the device before establishing any connection.
- Do not operate the device with the cover removed or loosened.
- Do not install substitute parts or perform any unauthorized modification to the product.
- Return the product to the manufacturer for service and repair to ensure that safety features are maintained

CAUTION

- This instrument is designed for indoor use and in area with low condensation.

The following table shows the general environmental requirements for a correct operation of the instrument:

Environmental Conditions	Requirements
Operating Temperature	5°C to 45°C
Operating Humidity	30% to 85% RH (non-condensing)
Storage Temperature	-10°C to 60°C
Storage Humidity	5% to 90% RH (non-condensing)

1. Visual A26 Software

1.1 Overview

High efficiency, extreme reliability, easiness of configuration and maintenance are the key features of the SY2604 bipolar power supply system.

The Visual A26 software has been developed to setup and to control the SY2604 system with a user friendly interface running on Windows Operating System. Different distributions of this software can run on MAC OS X or Linux Operating Systems.

The cited software allows users to:

- set and read the output current;
- read the output voltage and the status of the channel (interlocks, temperatures, DC-Link voltage, etc.);
- reset the power supply remotely;
- change channel parameters - e.g. PID compensation loop constants, maximum settable current, maximum slew rate [di/dt], etc.;
- update the DSP firmware.

1.2 Connection

Connect an Ethernet cable between the host computer running a Windows OS and the A2605BS power supply module in order to start communication with the channel.

Set the computer IP address on the same subnet used for the power supply. For instance, if the IP address of the A2605BS is 192.168.0.10 the computer's IP address must be 192.168.0.**x**, where **x** can be a decimal number between 1 to 244 but different from 10 (**Figure 1**).

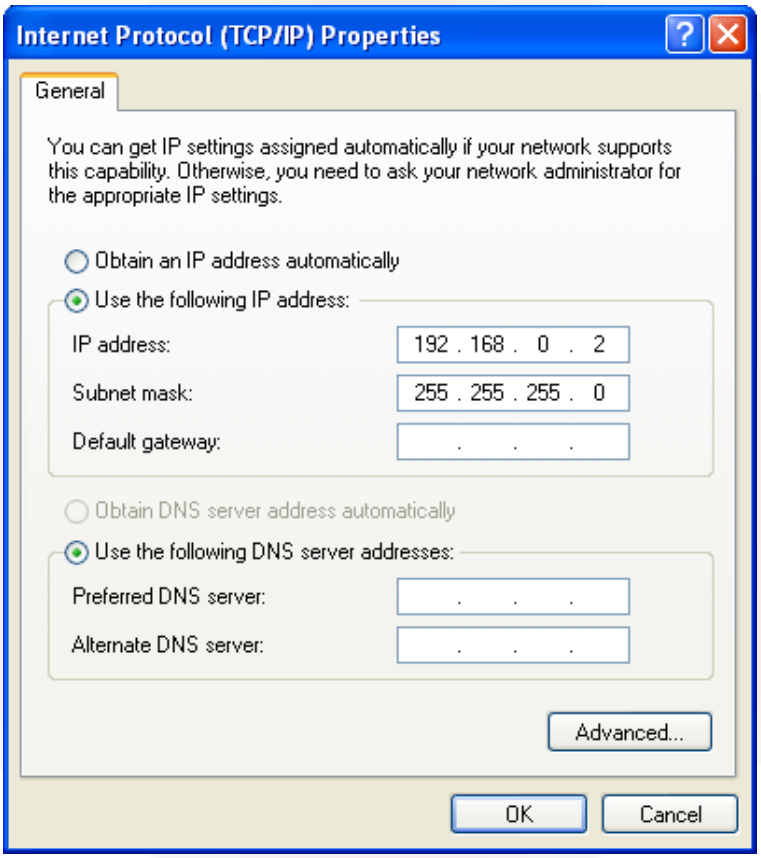
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 0 . 2
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Figure 1: host computer IP address Setup

Install the Visual A26 software by launching the file *setup.exe*. The installer can be downloaded from the CAENels website (www.caenels.com). Follow the procedure that will lead you through the application installation on your PC. It is now possible to launch the Visual A26 software: the main window should now appear, as shown in **Figure 2**.

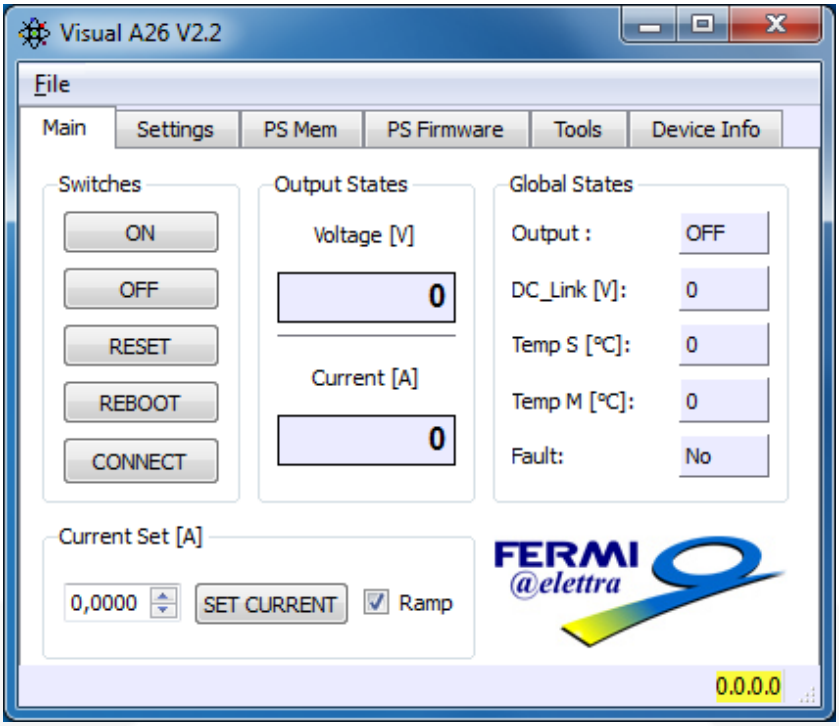

Figure 2: Visual A26 software *Main* TAB

1.3 Communication Setup

Enter the IP address of the power supply (PS) you want to control in the *Settings* TAB (**Figure 3**) and leave the port number to its default - i.e. 10001 - if this value has not been modified.

Please note that all modules are shipped with a standard IP address in the range of the following ones:

- **10.2.2.10**
- **10.2.2.11**
- **10.2.2.12**
- **10.2.2.13**

It is very important, before running the IP address configuration procedure, to set the host machine – i.e. PC – address to "static" and its IP to 10.2.2.1.

Standard communication port for the Ethernet device is 10001.

In the *Setup* TAB it is possible to choose the communication rate between the computer and the power supply unit.

Default *refresh* rate (which also defines the refresh of the data displayed on the software interface) is set to 200ms, but can be reduced down to 50ms to have a more frequent read of the PS status.

The *time-out* is defined as the maximum time for the computer to wait in order to have a response from the PS: after this time interval, expressed in ms, the reading is discarded.

The *Max* and *Min Set Current* values - in [A] - are respectively the maximum and minimum current values that can be set from the Visual A26 interface. These values can be set to 5 [A] and -5 [A] for the A2605BS power supply.

Clicking on the **Apply** button makes the inserted values active.

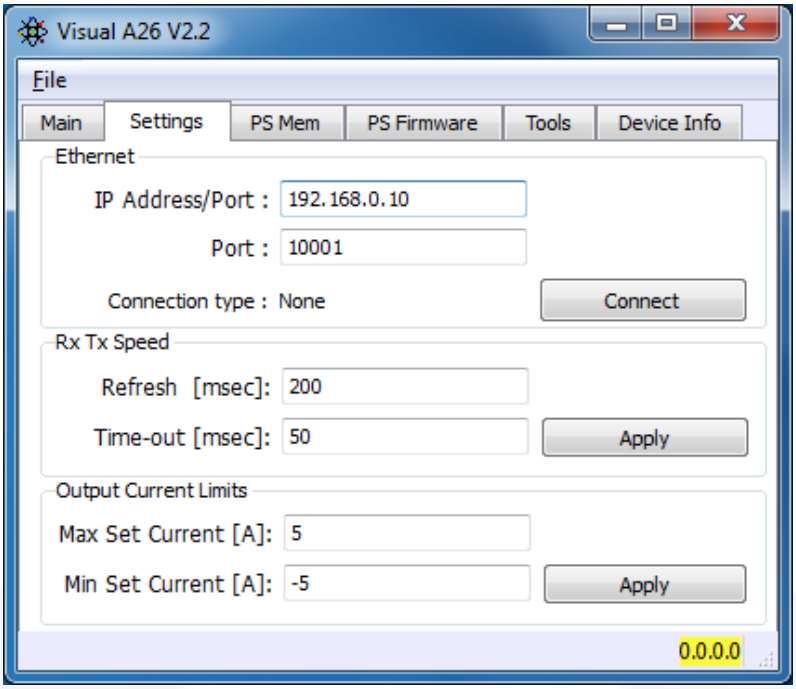

Figure 3: Visual A26 software *Settings* TAB

The **Connect** button initializes communication between the PS and the PC running the Visual A26 software. If the host is not reachable (check the power supply IP address, computer IP subnet and the cabling) a window will report the message "Connection host refused".

If everything is put into correct operation, the power supply identification name (contained in EEPROM cell #28) will be displayed on the Status Bar (**Figure 4**) as a confirmation that communication was established successfully.

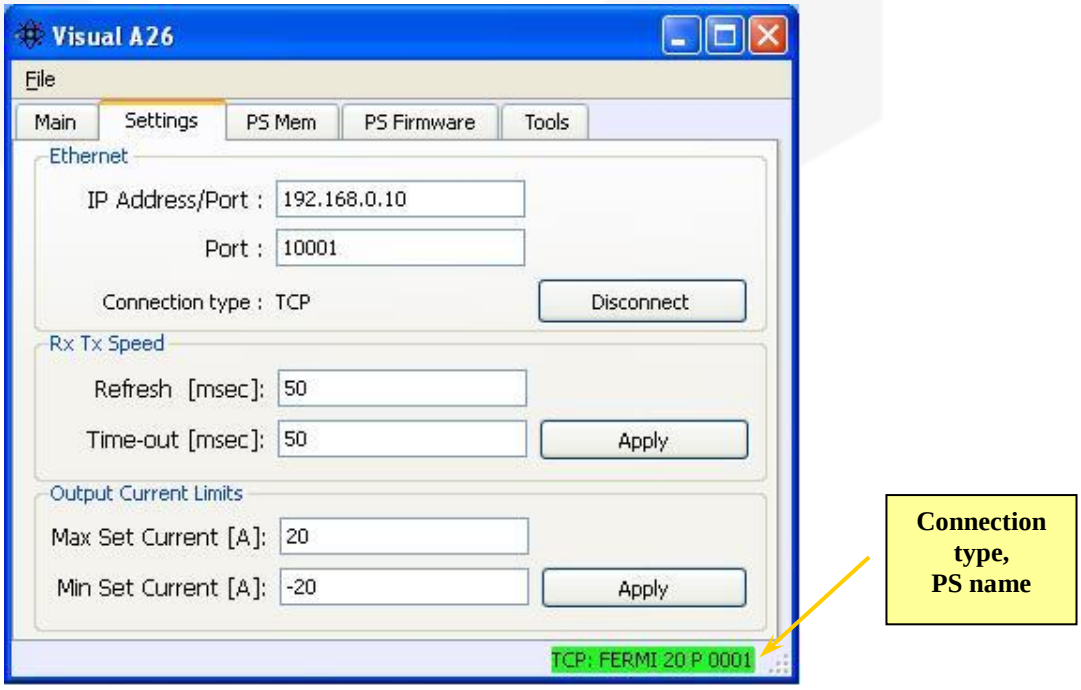

Figure 4: Visual A26 software - connection established

1.4 How to Control the A2605BS

When the communication with the A2605BS module has been established, it is possible to control and read its internal values and its status; this can be done from the Main TAB (**Figure 5**). In the ***Switches*** section:

- **ON**: enables the PWM pulses on the H-Bridge and starts current regulation (initial default to 0A);
- **OFF**: disables the PWM pulses on the H-Bridge. No current is fed to the load in this case;
- **RESET**: resets the power supply internal status register - i.e. to "No Faults" condition. The output stage is still disabled (OFF). If the fault cause has not been removed before resetting the status, the same fault condition will show up again;
- **REBOOT**: it resets the on-board digital signal processors by reloading the firmware stored in the Flash memory. If a parameter has been modified in the PS non-volatile memory, a Reboot command must be executed to make the last modification active.
- **Disconnect**: stops the communication between the power supply and the computer running the Visual A26 software.

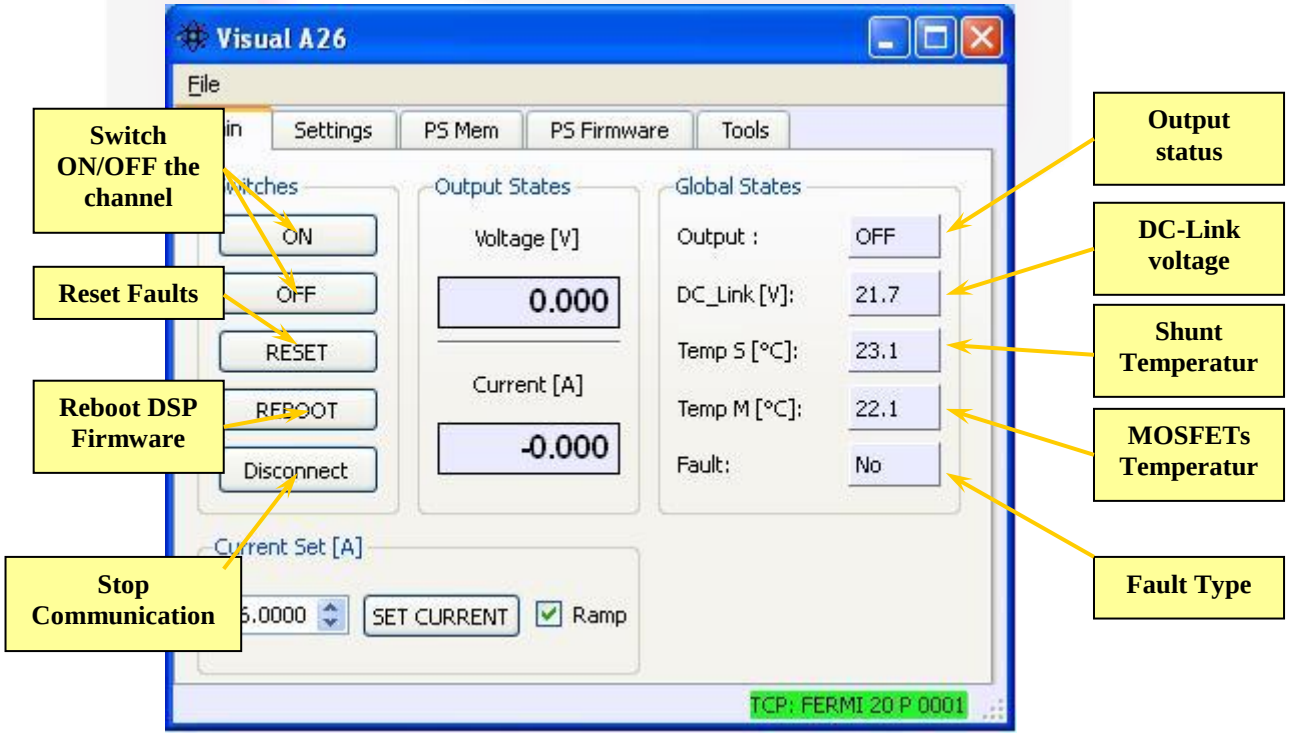

Figure 5: Visual A26 software - Main TAB description

In the ***Current Set [A]*** section:

- **Current Set [A]**: it is possible to set the desired output current value either by clicking on the arrows knob or by directly typing the number in the dedicated field;
- **SET CURRENT**: send the current value to the PS;
- **Ramp**: when active, makes the PS ramp to the current set value following the di/dt slew-rate imposed in the corresponding parameter (stored in the EEPROM). When the ramp is disabled the PS reaches the current set value as fast as possible (with its closed-loop response).

In the ***Output States*** section:

- **Voltage** [V]: displays the actual output voltage value in [V];
- **Current** [A]: displays the actual output current value in [A].

In the ***Global States*** section:

- **Output**: shows the output state of the PS channel. It is ON when the H-Bridge drives the load with the set current and OFF when there is no current at the output;
- **DC_Link [V]**: displays the DC-Link voltage value, measured after the input fuses mounted on the A2605BS board;
- **Temp S [˚C]:** displays the current sensing shunt heatsink temperature in [°C];
- **Temp M [˚C]:** displays the output MOSFET heatsink temperature [°C];
- **Fault:** indicates the type of fault occurred, if any. The same message is reported in the status bar and an example is shown in **Figure 6**.

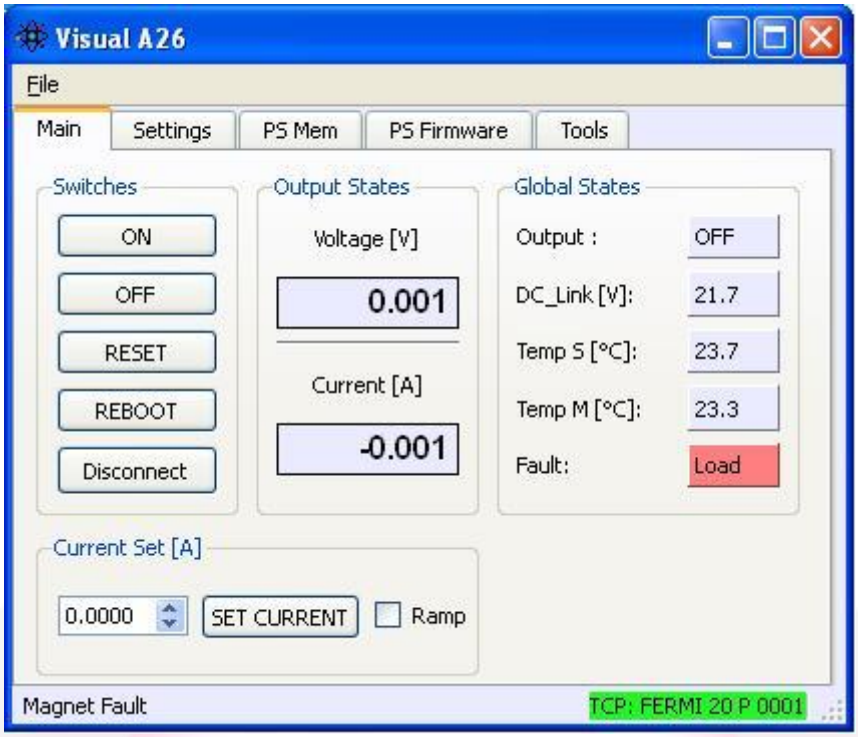

Figure 6: Visual A26 - external fault from the magnet/load

Possible fault conditions are shown in **Table 1**.

Fault	*Possible causes*
Magnet Fault	The jumper JP1 in the A2605BS board is not mounted or the 24V_{DC} voltage is not present on the interlock connector (pin 2 & 1)
DC Link voltage out of range	The Bulk power supply is not turned ON or the DC-Link cable is not connected properly or the DC-Link Fuses F1 & F2 are blown up
Over Current (OVC)	The input current exceeded the maximum value allowed for the channel
CrowBar	The output voltage exceeded the maximum value allowed for the channel. This can be due to a recovery of the energy stored in a large inductive load.
Shunt Over-temperature	The shunt heatsink exceeded the maximum allowable temperature (value defined in the EEPROM)
Mosfet Over-temperature	The MOSFET heatsink exceeds the maximum allowable temperature (value defined in the EEPROM)

Table 1: A2605BS possible fault conditions

1.5 A2605BS Memory Management

When the communication with the power supply has been established, it is possible to read and write the parameters stored in the internal EEPROM memory; this can be done from the *PS Mem* TAB (**Figure 7**).

These parameters define, in different ways, the behaviour of the A2605BS power supply.

Some memory cells are write-protected to avoid accidental or unwanted modifications of the data that could compromise either the module hardware or the correct load current regulation.

A password is required to change the write-protected cells.

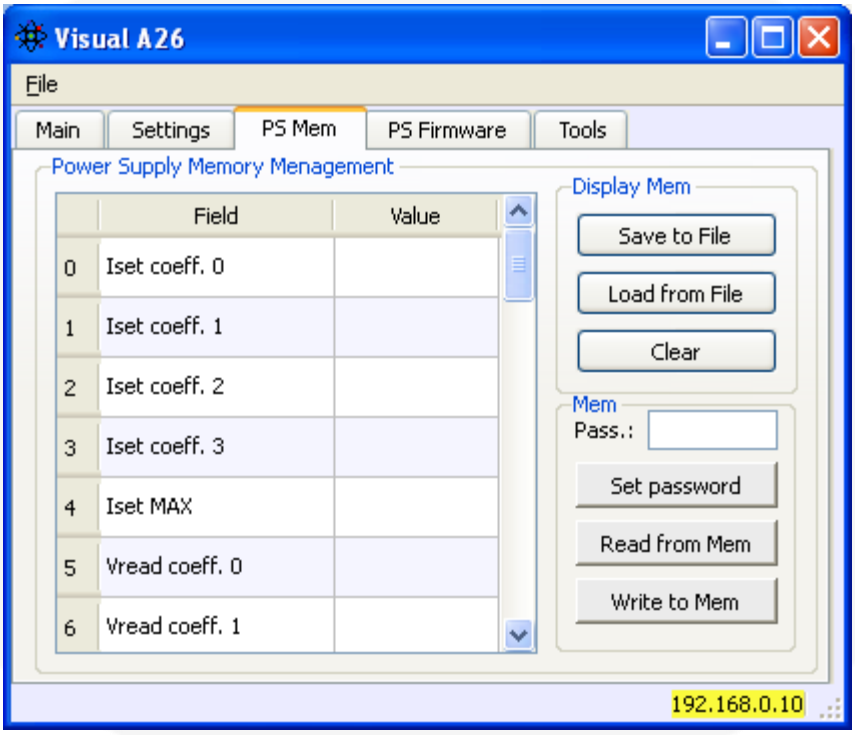

Figure 7: Visual A26 software - memory management

In the ***Power Supply Memory Management*** table:

- **Field**: indicates the description of the specific EEPROM cell;
- **Value**: numeric data or string stored in the EEPROM memory cell;

In the ***Display Mem*** section:

- **Save to File**: saves the Values listed in the table into a proprietary text-based file (.EP5) located on the local hard disk;

- **Load from File**: loads in the table the Values of a previous saved .EP5 file;
- **Clear**: clears the values of the table.

In the ***Mem*** section:

- **Pass.:** text field to type the password to "write-enable" the protected cells;
- **Set password**: "write-enables" the EEPROM cells if the Pass. content is correct;
- **Read from Mem:** reads all memory cells from the connected A2605BS module and displays Values in the table;
- **Write to Mem:** if password has been inserted and the module is then write-enabled, all the Values displayed in the table will be stored in the corresponding EEPROM cells; if no (or wrong) password was set, only the un-protected cells will be updated. No EEPROM cells are updated if there is no character written the table.

The structure of the non-volatile memory (EEPROM) is presented in Annex A.

1.6 Firmware Update

The A2605BS has two different digital signal processors (DSP): one is dedicated to communication and diagnostics while the other one to perform the digital current control loop.

By using the Visual A26 software it is possible to upgrade the DSP firmwares with a new release. Visual A26 also allows users to upgrade the Ethernet XPort device (Ethernet) mounted on the A2605BS.

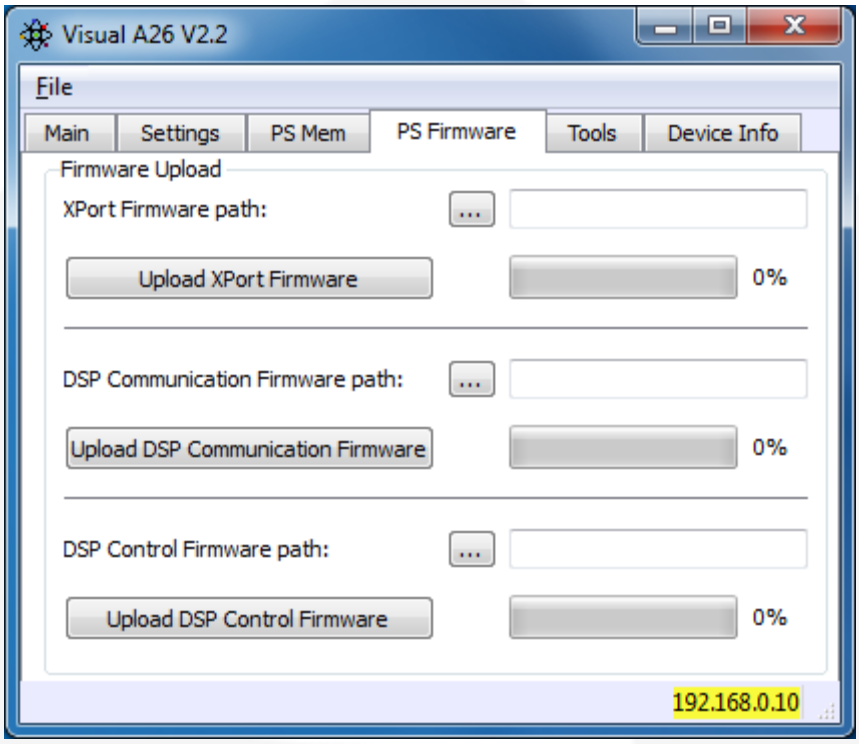

Figure 8: Visual A26 - firmware update

A description of the fields/tabs present on the *PS Firmware* TAB is herein listed:

- **Upload XPort Firmware:** starts to upload the firmware on the Ethernet device. A message dialog will report that the procedure has successfully completed if the process ends without errors;
- **DSP Communication Firmware path:** choose the new firmware file (with **.hex** extension) for the Communication DSP;
- **Upload DSP Communication Firmware:** starts to upload the firmware on the Communication DSP. A message dialog will report that the procedure has successfully completed if the process ends without errors;
- **DSP Control Firmware path:** choose the new firmware file (with **.hex** extension) for the Control DSP;

- **Upload DSP Control Firmware:** starts to upload the firmware on the Control DSP. A message dialog will report that the procedure has successfully completed if the process ends without errors.

1.7 Tools

When there is the need to setup a new power supply, the *Tools* TAB provides basic functionalities to setup the IP address and communication protocol. The main fields, shown in **Figure 9**, are herein listed:

- **Set the communication protocol:** sets the communication protocol with the remote client - e.g. Visual A26. Click on the Apply button to change the Ethernet device configuration with the selected communication protocol;
- **Old IP Address:** type the IP address number of the power supply that has to be changed;
- **New IP Address:** type the new IP address for the power supply. Click on the Apply button to change the IP number of the Ethernet device. The Subnet Mask and the Gateway will not change.

***NOTE*:** the subnet of the computer must be the same of the Old IP Address and New IP Address.

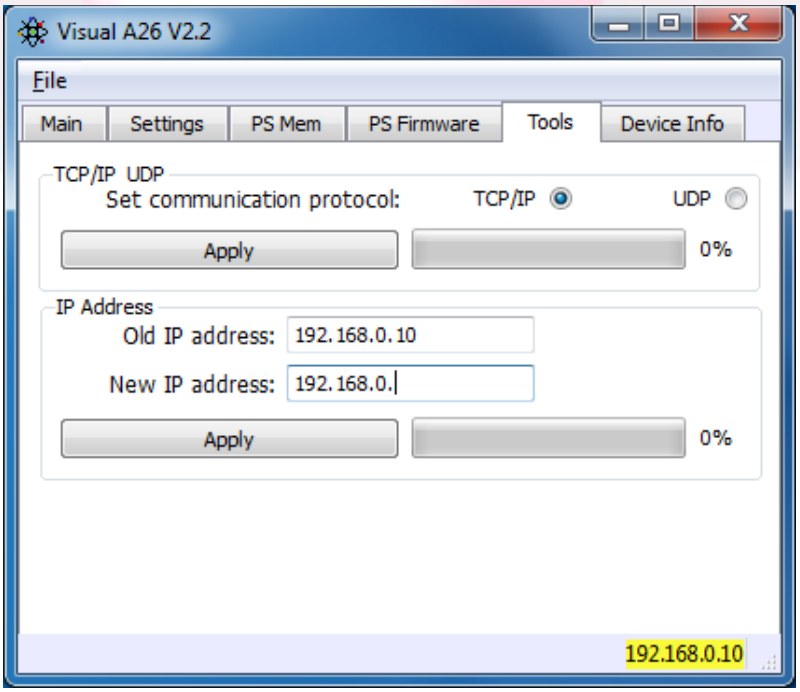

Figure 9: Visual A26 - Tools

1.8 Device Info

Information on the A2605BS power supply can be found under the *Device Info* TAB, shown in Figure 10. The power module MAC address and the communication DSP firmware are herein presented.

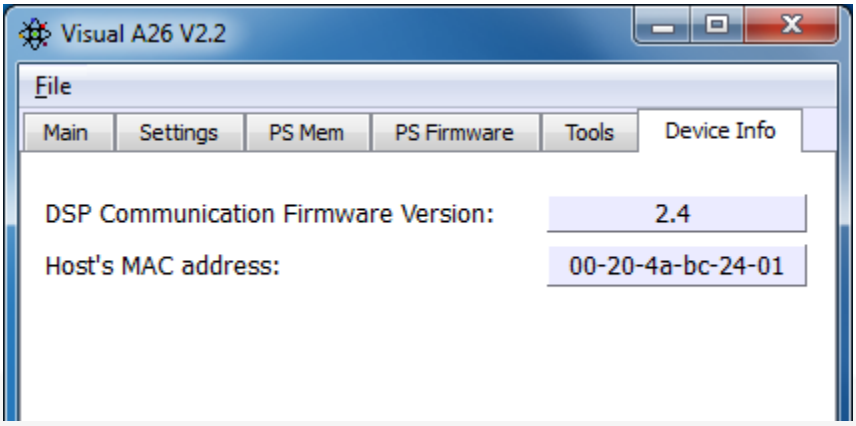

Figure 10: Visual A26 - Device Info

1.9 Save Configuration

In the ***File*** menu, the ***Save*** command will save the configuration of the Visual A26 software, i.e. the Settings parameters and the firmware file paths.

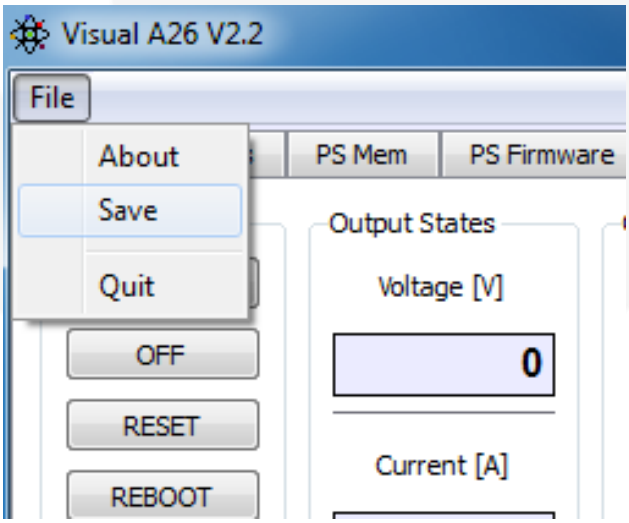

Figure 11: Visual A26 - File menu

After having saved the Visual A26 configuration, the software will start-up the following time with the saved parameters.

Annex A

Please note that:

- cells marked in **blue** are password-protected;
- cells marked in **green** are not accessible by the user (factory-reserved).

Cell #	Cell Caption	Description
0	c_0I_set	Zero-order current calibration coefficient
1	c_1I_set	1st-order current calibration coefficient
2	c_2I_set	2nd-order current calibration coefficient
3	c_3I_set	3rd-order current calibration coefficient
4	I_{max}	Maximum settable current set-point
5	c_0V_read	Zero-order voltage calibration coefficient
6	c_1V_read	1st-order voltage calibration coefficient
7	c_2V_read	2nd-order voltage calibration coefficient
8	c_3V_read	3rd-order voltage calibration coefficient
9	c_0DC_Link	Zero-order DC-link calibration coefficient
10	c_1DC_Link	1st-order DC-link calibration coefficient
11	c_2DC_Link	2nd-order DC-link calibration coefficient
12	c_3DC_Link	3rd-order DC-link calibration coefficient
13	K_P - proportional constant	PID regulator proportional gain
14	K_I - integral constant	PID regulator integrative gain
15	K_D - derivative constant	PID regulator derivative gain
18	Newton-Raphson Iterations	Number of iterations for inverse calibration
19	*reserved*	
20	Max MOSFET Temperature	Maximum MOSFET heatsink temperature
21	Max SHUNT Temperature	Maximum shunt resistor temperature
22	Serial Number	Module serial number
23	Undervoltage Protection	Under-voltage protection threshold
24 … 25	*reserved*	
26	Calibration Date	Date of last calibration
27	Identification	Module identification name
28 … 29	*reserved*	
30	Slew Rate [A/s]	Module slew rate value

Table 2: EEPROM "Value" section